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Foraminifera
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A Small Molluscan Fauna from Costa Rica

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FORAMINIFERA AND A SMALL MOLLUSCAN FAUNA FROM COSTA RICA

BY

KATHERINE VANWINKLE PALMER

The present paper represents a report on material sent from Costa Rica to the Cornell Paleontological Laboratory by A. C. Veatch of the Sinclair Consolidated Oil Company.

The greater portion of the fossils are of diminutive size, consisting mainly of foraminifera with associated mollusca. The material came from a portion of a well section at Cahuita, Costa Rica, in the Uscari shales of lower Miocene age, at depths of 3818 and 3861.5 ft. Since the fauna from the Uscari shales is little known and the present material represents a lower portion of the shales than heretofore described, a few illustrations seem desirable.

Mr. Axel Olsson *, who first described and named the Uscari formation of Costa Rica, has listed and described a few species. His fauna came from the upper shales. The fauna in this report occurs lower in the formation.

The following are the species which Mr. Olsson gives from the Uscari shales:

Alectrion merenda Olsson.
Cancellaria islacolonis Maury.
Chlorostoma costaricensis Olsson.
Malea elliptica Pilsbry & Johnson.
Neverita nereidis Maury.
Ptychosalpinx ? *dentalis* Olsson.
Scaphella costaricensis Olsson.
Sconsia cocleana Olsson.
Sistrum nodulosum C. B. Adams (Uscari and Gatun Transitional beds)
Strombus pugiloides Guppy.

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* Olsson, Axel, Bull. Amer. Pal. vol. IX, No. 39, pts. 1 and 2, 1922.

Volvula cercadensis VanWinkle (= *V. cylindrica* Gabb).
Amusium Lyonsii Gabb.
Arca dariensis Pilsbry & Johnson.
Clementia dariena Conrad.
Pteria inornata Gabb.
Dentalium uscarianum Olsson.

To which may be added from near Old Harbor in the upper shales:

Corbula vieta Guppy.
Leda davilæ Olsson.
Pecten aotus Olsson.
Sinum gatunensis (Toula).
Lævicardium serratum Linné.
Chione (*Lirophora*) *hotelensis* Olsson.
Cristellaria cultrata (Montfort).

The following is the list from the Cahuita shale:

Cristellaria cultrata (Montfort).
Frondicularia alata d'Orb.
Nodosaria sp.
Pulvinulina menardii d'Orb.
Triloculina tricarinata d'Orb.
Drillia consors Sowerby.
Drillia sp.
Terebra sp.
Crassinella cahuitensis n. sp.
? *Crassinella guppyi* Dall.
? *Glycymeris acuticostatus* Sowerby.
Phacoides actinus Dall.
Leda davilæ Olsson.
Pecten aotus Olsson.
Thyasira sp.

In addition to the Uscari fauna, the report includes some species of Foraminifera from a dark gray, calcareous, volcanic compact sand from MacDonald and Nigua Creeks. A species of *Nummulites* was found to be fairly abundant indicating the age to be Eocene or Oligocene. A single, poor specimen, which is with little doubt a small species of *Lepidocyclina* was found, which tends to affirm more strongly the Oligocene age of the sediments.

The localities referred to in the text are as follows:

1. Cahuita well, about 22 miles southeast of Limon, 82° 50′ West, 9° 45′ North, Costa Rica. At depth of 3818 and 3861.5 ft.

2. MacDonald Creek, 7 miles south of Guabilo, 82° 40′ West and 9° 25′ North, Costa Rica.

3. Nigua Creek, 5 miles west of Alamirante, 82° 27′ West and 9° 20′ North, Costa Rica.

PROTOZOA

Order FORAMINIFERA

Family LAGENIDAE

Genus **NODOSARIA** Lamarck

Nodosaria sp. Plate 1, Figures 1, 6, 11

Cf. Nodosaria lamellosa d'Orb. 1826 Ann. des Sci. Nat. Ser. I, 7, p. 253, pl. 10, figs. 4, 5, 6.

Cf. Nodosaria sp. Cushman 1922 U. S. G. S., Prof. Paper 129-E, p. 93, pl. XVI, fig. 5.

Several fragments of a *Nodosaria* were found which do not give the characters of a complete specimen but which show the ornamentation over the chambers present, beautifully preserved; the chambers are well-defined and the larger are subglobular. One fragment of three chambers shows the contour of each successive, indivual chamber, away from the largest, decreasing in convexity; surface ornamented with stout, longitudinal costæ of which there are from ten to twelve in number. The number and character of the costæ may be compared with *N. lamellosa* d'Orb. and a *Nodosaria* sp. of Cushman; the figure of d'Orbigny however shows all of the chambers of nearly equal convexity. The *Nodosaria* sp. which Dr. Cushman found and figured a single broken specimen from the Oligocene Byram calcareous marl at Byram, Miss., appears very much like the specimens in our material.

A broken specimen of two chambers, shows on the larger one a series of intermediate costæ as on some Lagenas. See figs. 1, 11, plate 1. There are eight primary costæ, with five, secondary ribs, the secondary costæ do not occur between all of the primaries and are not present on the succeeding chamber.

Occurrence: Lower Miocene, Uscari shale from Cahuita well, Costa Rica.

Nodosaria soluta (Reuss) Plate 1, Figure 5

Dentalina soluta Reuss 1851 Zeitschr. d. deutsch. geol. Gesell. vol. 3, p. 60, pl. III, fig. 4, a, b.

Nodosaria soluta Bornemann 1855 Zeit. d. deutschen geol. Gesell., 7, p. 322, taf. XII. fig. 12; Brady 1884 Rep. Voy. Challenger Zoology vol. 9, p. 503, pl. 62, figs. 13-16; pl. 64, fig. 28; Flint 1899 Recent Foram. U. S. Nat. Mus. p. 310, pl. 56, fig. 3.

Test nearly straight, stout; chambers globular; the collection contains one specimen with six chambers present; aperture protruding with faint, radiating fissures about the exterior; surface of chambers smooth with faint, longitudinal striations at the sutures, extending shortly above and below the sutural line.

Length, 5 mm. (Incomplete specimen).

Occurrence: Nigua Creek, Costa Rica.

Genus **VAGINULINA** d'Orbigny

Vaginulina legumen (Linnæus) Plate 1, Figure 2

Nautilus legumen Linnæus 1758 Syst. Nat. 10th ed., p. 711, No. 248; 1767, 12th ed., p. 1164, No. 288.

Vaginulina legumen Brady 1874 Rep. Voy. Challenger, Zoology vol. 9, p. 530, pl. 66, figs. 13-15.

Test linear, sides nearly straight, only very slightly irregular, gradually tapering to the anterior end although the difference in width is only slight between the two ends; smooth; initial chamber large and round occupying the whole of the posterior tip; sutures oblique, thick, distinct; aperture marginal, slightly pouting.

Dimensions: 5 x 1 mm.

Occurrence: Specimen figured, MacDonald Creek; Nigua Creek, Costa Rica.

Genus **CRISTELLARIA** Lamarck

Cristellaria cultrata (Montfort) Plate 1, Figure 8

Robulus cultratus Montfort, 1808, Conch. Syst. vol. 1, p. 214, 54 genre.

Cristellaria cultrata Brady 1884 Rep. Voy. Challenger, Zoology, vol. 9, p. 550, pl. 70, figs. 4, 5, 6, 7, 8; Bagg 1898 U. S. G. S. Bull. 88, p. 55, pl. VI, fig. 1; Flint 1899 Recent Foram. U. S. Nat. Mus., p. 318, pl. 65, fig. 2.

Test round, biconvex and smooth; margin sharp with a wide keel; chamber walls distinct, strong and thick; aperture slightly protruding, marginal.

The specimen figured is the largest of all the material, measuring 5 mm. in diameter and it shows the characters beautifully and distinctly. The species is apparently the most common of all the species found, as numerous specimens from various localities, although the characters are not as clearly shown, appear to be this species. The smallest is from the Cahuita well, measuring 1 mm. in diameter.

Occurrence. Specimen figured, MacDonald Creek, Costa Rica; Nigua Creek, Cahuita well, Costa Rica.

Cristellaria *cf.* **reniformis** d'Orbigny Plate 1, Figure 10

Cristellaria reniformis d'Orbigny 1846 For. Foss. Vien. p. 88, pl. III, figs. 39, 40; Brady 1884 Rep. Vol. Challenger Zoology, vol. 9, p. 539, pl. 70, fig. 3; Flint 1899 Recent Foram. U S. Nat. Mus., p. 315, pl. 62, fig. 2.

Test sub-elongate, compressed, smooth; margin with a wide, sharp keel; chamber walls strong and thick, exteriorly raised above the surface of chambers, some inconspicuously nodose; aperture marginal.

Dimensions: 4 x 3 mm.

Occurrence: Specimen figured, MacDonald Creek; Nigua Creek, Costa Rica.

Genus **FRONDICULARIA** Defrance

Frondicularia alata d'Orbigny Plate 1, Figure 13

Frondicularia alata d'Orb. 1826 Ann. des Sc. Nat. Ser. I, 7, p. 256; Parker, Jones & Brady 1871 Ann. Nat. His. VIII, p. 161, pl. X, fig. 66; Brady 1884 Rep. Voy. Challenger Zoology, vol. 9, p. 522, pl. 65, figs. 20-23, pl. 66, figs. 3-5; Flint 1899 Recent Foram. U. S. Nat. Mus., p. 313, pl. 59, fig. 1.

Triangular, compressed, smooth and transparent; initial chamber distinct, globular, slightly raised beyond the surface of the remainder of the test; succeeding chambers V-shaped, the point of the V directed away from the initial chamber; the mid-line appearing like a series of vertebræ; aperture terminal; the line of the free end of the chambers is partially broken so that the true nature is not known; free end of early chambers slightly projecting.

Length: 4.5 mm.

Occurrence: Lower Miocene, Uscari shale from Cahuita well, Costa Rica.

Frondicularia sp. Plate 2, Figure 5

A large weathered specimen of *Frondicularia* was found in the MacDonald Creek material which is not *F. alata*. It measures 9 mm. in length. The specimen has been figured for future comparison, on plate 2.

Genus **PULVINULINA** Parker & Jones

Pulvinulina menardii (d'Orbigny) Plate 1, Figure 7

Rotalia menardii d'Orbigny 1826 Ann. Sci. Nat. vol. 7, p. 273.

Pulvinulina menardii Brady 1884 Rep. Voy. Challenger, Zoology, vol. 9, p. 690, pl. 103, figs. 1, 2; Cushman 1918 U. S. Nat. Mus. Bull. 103, p. 70, pl. 25, figs 2, 3,

Test plano-convex, thin and smooth except for dense and fine punctations; outer margin and line between the chambers distinct, raised and rounded; six chambers in the last-formed whorl.

Diameter: .5 mm.

Ocurrence: Lower Miocene, Uscari shale from Cahuita well, Costa Rica.

Genus **NUMMULITES** Lamarck

Nummulites costaricensis, n. sp. Plate 1, Figures 9, 12

Test small, thin, complanate; exterior smooth, slightly irregular; convolutions five; segments strongly arcuate; alar prolongations of the segments regular, sinuo-radiate; chambers numerous about twice as high as long, 32 in next to the last convolution; central convolution small, height of chambers increasing outwardly; aperture and canal system unknown. Small specimens 1.5 mm. in diameter which we take to be young, are very much thicker than the larger specimens.

This species is of the size of *N. davidensis* Cushman and the characters of the chambers are the same. This species however would have more than twice the number of chambers in the last convolution. In the larger number of chambers it is more like *N. panamensis* Cushman and yet has as a greater number than that species. There are 32 chambers in the convolution next to the last in *costaricensis.* The last whorl in our sections is too badly destroyed to determine the number of chambers. It would probably have a number approaching that of *N. willcoxi* Heilprin of the Ocala limestone of Florida. The number in that species is given as 35-45. The young specimens of *costaricensis* are like *N. willcoxi* in thickness and shape but the larger specimens are compressed, thin and more or less irregular. Since the septal prolongations have not been described for the Panama species and a systematic study made of all the North American species of *Nummulities* we feel it best to give the Costa Rican species a distinct name for the present.

Dimension: 3.5 mm. in diameter.

Occurrence: Nigua Creek and MacDonald Creek, Costa Rica. Fairly abundant.

Genus **TRILOCULINA** d'Orbigny

Triloculina tricarinata d'Orbigny Plate 1, Figures 3, 4

Triloculina tricarinata d'Orbigny 1826 Ann. Sci. Nat. vol. 7, p. 299.

Miliolina tricarinata Brady 1884 Rep. Voy. Challenger, Zoology, vol. 9, p. 165, pl. 3, figs. 17a, b.

Triloculina tricarinata Cushman 1918 U. S. Nat. Mus. Bull. 103, p. 82, pl. 32, fig. 2.

Test minute, oval and smooth; apertural view triangular, sides convex, slightly concave towards the borders, angles acute; aperture round, tooth absent.

Length: .75 mm.

Occurrence: Lower Miocene, Uscari shale from Cahuita well, Costa Rica.

MOLLUSCA

Genus **TEREBRA** Lamarck

Terebra sp. Plate 2, Figure 4

Finding only one small specimen of *Terebra* we have included the illustration but do not attempt to determine it specifically.

Genus **DRILLIA** Gray

Drillia consors Sowerby Plate 2, Figure 7

A single specimen of *Drillia consors* was found. This practically represents the only large or moderately large species found in the Cahuita material. A specimen of *D. consors* from Santo Domingo has been figured for comparison.

Drillia sp. Plate 2, Figure 6

A broken specimen of a *Drilla* from the Cahuita material is figured. It is not perfect enough to compare with known species but is figured for future comparison.

Genus **GLYCYMERIS** Da Costa

Glycymeris cf. **acuticostatus** (Sowerby) Plate 2, Figure 9

Pectunculus acuticostatus Sowerby, 1849 Quart. Jour. Geol. Soc. Lon. V, p. 53, pl. X, fig. 13.

A small, single specimen of *Glycymeris* was found in the Uscari shale material which has the ribs perfect, fully preserved. The specimen is 6 mm. in height and 6.5 mm. in width. It may represent an adult shell or the young of some species. Having only one specimen we can not definitely say and have only compared it with *G. acuticostatus* Sowerby because in shape, character and number of the ribs it is like young specimens of *G. acuticostatus* Maury in the Santo Domingo collection. There are twenty-six, radiating ribs which are pronounced, V-shaped or rounded and have very narrow interspaces.

The shell is from the Uscari shale of the Cahuita well, Costa Rica.

Genus **CRASSINELLA** Guppy

Crassinella cahuitensis, n. sp. Plate 2, Figure 2

Description: Shell small, equilateral; beaks pointed, minute; anterior end high and convex; moderately concave beneath the beaks posteriorly; surface with fifteen, rounded, concentric ribs with interspaces equal to the width of the rib. In shape this species is like *C. martinicensis* d'Orbigny but it has a greater number of concentric ribs which are not as sharp but are more rounded than *martinicensis*.

Dimensions: Height 3 mm.; width 3 mm.

Occurrence: Lower Miocene, Uscari shale from Cahuita well, Costa Rica.

Genus **PHACOIDES** Blainvile

SECTION BELLUCINA

Phacoides actinus Dall, var. **uscarensis**, n. var. Plate 2, Figures 1, 3

Several specimens of a small *Phacoides* which bears a resemblance to *P. actinus* Dall (Trans. Wag. Inst. Sci. III, pt. 6, p. 1385, pl. 52, fig. 3) occur well preserved. They are larger than *actinus* with a greater number of radiating ribs, there being twenty-two on the Uscari specimens. In other respects the shells have the characters of typical *actinus*. The specimens of this species which Mr. Olsson records from the Gatun beds of Bocas del Toro, Costa Rica have been compared. They are very small and do not have the radiatiug ribs developed to the extent of *uscarensis*. The Santo Domingo specimens reported by Dr. Maury also have a smaller number of ribs.

Dimensions: Height 6 mm.; width 5.5 mm.; semidiameter 2 mm.

Occurrence: Lower Miocene, Uscari shale fron Cahuita well, Costa Rica.

ORBITOLITES FROM THE EOCENE OF OREGON

As a result of a collecting trip from the Eocene of Western Oregon in the summer of 1919, a large amount of fossil material was obtained from old and new localities. At one locality in Coos County a moderately large species of foraminfera was very numerous. This form was very noticeable, particularly as it was not found at other localities. An examination of the specimens shows the form to be a species of *Orbitolites* which we take occasion to describe in the present paper. Not only is the form of interest in its occurrence but in the character of the associated mollusca as well. The fauna is of the same horizon as that at Glide and vicinity, on the Little River, in the Roseburg Quadrangle, Oregon and certain localities in California which are of Meganos, Mid-Eocene age. This fact is of considerable interest as it means the further extension in Oregon of the middle Eocene horizon heretofore found only at the one region in Douglas County.

Orbitolites is a beach foraminifera occurring abundantly in shallow water sands. This accounts for its association with the shallow to moderate depth molluscan fauna. Three other species of foraminifera were found: *Cristellaria crepidula* (Fichtel and Moll.), *Cristellaria rotulata* (Lamarck) and *Nodosaria obliqua* (Linnæus). The first species was also abundant. It is a typical shallow water form. *C. rotulata* and *N. obliqua* are widely distributed occurring from the shallows to the depths.

Genus **ORBITOLITES** Lamarck

Orbitolites oregonensis, n. sp. Plate 2, Figures 10, 11, 12, 13, 14

cf, *Orbitolites* sp. *a*. Arnold 1909 Bull. U. S. G. S. 396, p. 13, pl. III, fig. 6.

Description. Test flat, very thin, medium in size, surface minutely granulate which under the microscope gives the appearance of a fine, beaded structure. On certain portions of some specimens the beads are arranged in regular, concentric rows; see pl. 2, fig. 12. Some specimens show the central portion of the disk slightly more convex than the surrounding surface; see pl. 2, fig. 13; chambers in one tier; chamberlets numerous; megalospheric tests comparatively numerous and show a large round central nucleus with a large second chamber which surrounds the primordial chamber about half its circumference, this is followed by the regular cyclic arrangement of the minute chamberlets, see pl. 2, fig. 16; marginal pores in a single row.

The general appearance and arrangement of the chamberlets is like that of *C. americana* Cushman from the Oligocene of Panama.

Arnold has figured from the Eocene of the Coalinga region, California (Bull. U. S. G. S. 396, p. 13, pl. III, fig. 6) the exterior view of an *Orbitolites* which he states is common. The size is given as 7.5 mm. in diameter which is the size of the Oregon species. The largest specimens in our material measure about 8 mm. in diameter, the average being about 5 mm. in diameter.

Type: Pal. Museum Cornell Univ.

Occurrence: On Four Mile Creek, Coos County, under an old bridge at Sam Smith's old place now DeLong place (1919). Section 4, Township 30 South, Range 14 West.

Horizon: Meganos. Middle Eocene.

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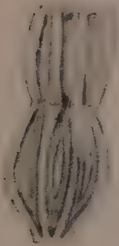

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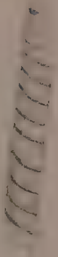

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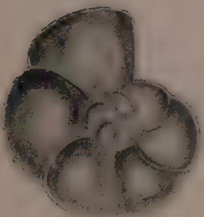

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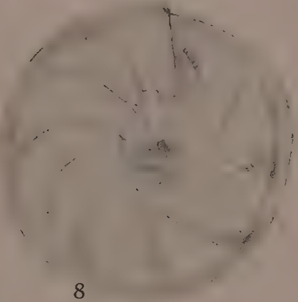

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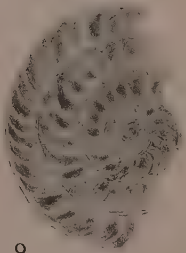

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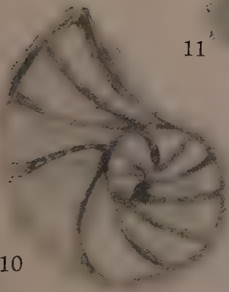

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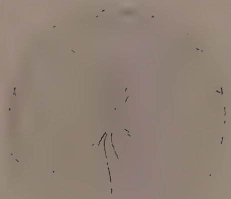

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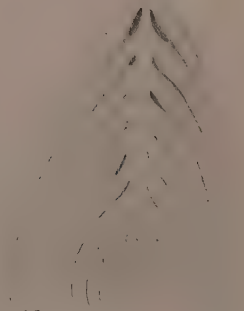

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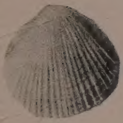
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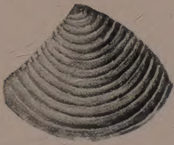
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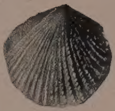
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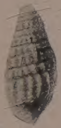
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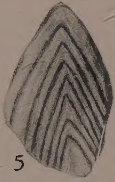
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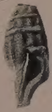
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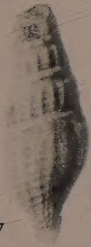
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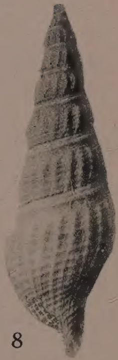
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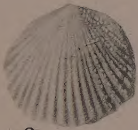
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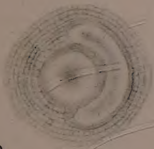
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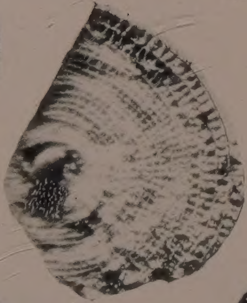
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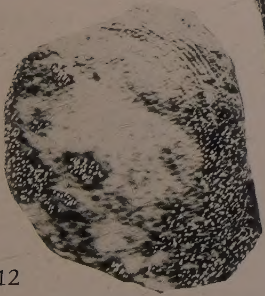
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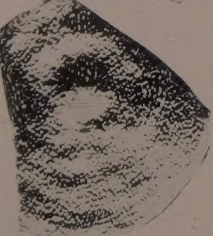
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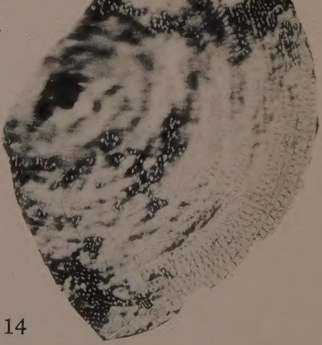
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